

Transfemoral Transvenous Embolization of Dural Arteriovenous Fistulas Involving the Isolated Transverse-Sigmoid Sinus

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Summary

Dural arteriovenous fistulas involving the transverse-sigmoid sinus (T-S dAVFs) are sometimes isolated because this affected sinus is often thrombosed. It is difficult to perform microcatheter cannulation to the isolated sinus through the thrombosed portion. We are now treating these T-S dAVFs by transfemoral transvenous embolization via the ipsilateral side even if the affected sinus is thrombosed and isolated or not. We use a triaxial system (6 Fr. guiding catheter / 4 Fr. diagnostic catheter / microcatheter) to emphasize the pushability and handling of the microcatheter. And we insert 4 Fr. Catheter into the affected sinus. So we can perform microcatheter cannulation into the isolated and affected sinus for treatment by coil embolization with various detachable coils.

Introduction

T-S dAVFs have various symptoms, not only tinnitus but also neurological deficits caused by venous hypertension or hemorrhage¹⁻⁵. So it is necessary to treat these T-S dAVFs to reduce the neurological risk. Generally, the treatment for T-S dAVFs is transfemoral transvenous embolization, but T-S dAVFs are sometimes isolated because of a thrombosed sinus and microcatheter cannulation is difficult³. Some reports gave treated isolated T-S dAVFs such as by the

contralateral approach¹ or direct puncture⁶, etc. We basically treat these dAVFs by transfemoral transvenous embolization via the ipsilateral side if there is a thrombosed and isolated sinus or not. We report our technique to insert the microcatheter through the thrombosed sinus.

Materials

Table 1 summarizes the patients of this study. Seven patients were studied during four years in our hospital. The patients included three women and four men ranging in age from 42 to 72 years (mean age, 56.8 years). All patients were diagnosed with dAVFs involving the isolated transverse-sigmoid sinus (T-S sinus) because the distal and proximal portions of T-S sinus were thrombosed. In all cases, head computed tomography or magnetic resonance imaging showed a pattern of venous infarction including three hemorrhagic cases. Their clinical symptoms were epilepsy in two cases, aphasia in four cases, visual disturbance in three cases and cerebellar dysfunction in two cases.

Technique

We treated patients by transfemoral transvenous embolization under local anesthesia. We used a triaxial system (6 Fr. guiding catheter / 4 Fr. diagnostic catheter / microcatheter) to im-

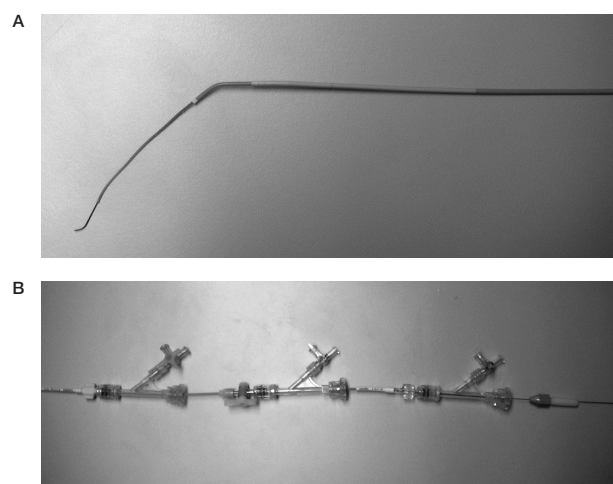


Figure 1 Triaxial system 6Fr. guiding catheter / 4Fr. diagnostic catheter/microcatheter (Envoy XB) (Berenstein type) (Transit II)

prove the pushability and handling of a guidewire or microcatheter.

We use Envoy XB (Cordis, FL, USA) as a 6Fr. guiding catheter, Berenstein catheter (Tonokura, Tokyo, Japan) as a 4Fr. diagnostic catheter and RapidTransit (Cordis) as a microcatheter (figure 1). First we punctured both the femoral artery and vein, and inserted both 4Fr. and 6Fr. sheath introducers. For diagnosis and recognition of dAVFs, we inserted a 4Fr. diagnostic catheter into the ipsilateral common carotid artery by the Seldinger method transarterially. Next, we inserted a 6Fr. guiding catheter and a 4Fr. diagnostic catheter into the jugular bulb on the ipsilateral side using the coaxial method transvenously. Manipulating a 0.035 inch guidewire (Terumo, Tokyo, Japan)

gently into the thrombosed sinus, we inserted not only the guidewire but also a 4Fr. diagnostic catheter into the thrombosed sinus with a 6Fr. catheter wedged at the bulb of the jugular vein. We manipulated the guidewire and 4Fr. Catheter together. To confirm the true lumen, we sometimes inject contrast medium gently from 4Fr. catheter transvenously. We identified the right route and manipulated the guidewire and 4Fr. catheter.

The guidewire and 4Fr. catheter were inserted into the affected sinus through the thrombosed sinus, and we could cannulate the microcatheter in place of the guidewire. Then we packed the isolated sinus using GDC (Boston Scientific, MA, USA), DETACH (Cook, Bjaeverskov, Denmark) and Trufill DCS (Cordis) from the distal site of the isolated sinus until dAVFs disappeared.

Results

We could treat all patients by transfemoral transvenous embolization via the ipsilateral thrombosed and isolated sinus. The clinical symptoms of all patients disappeared rapidly, and there were no complications during these treatments (morbidity 0%, mortality 0%).

Table 1 summarizes the results of this study. We show how to treat the typical case and our technique in figures 2 to 5.

Discussion

The main clinical symptom of T-S dAVFs is tinnitus¹, but dAVFs are often accompanied by sinus thrombosis changing the pattern of venous drainage. So it causes intracranial hemor-

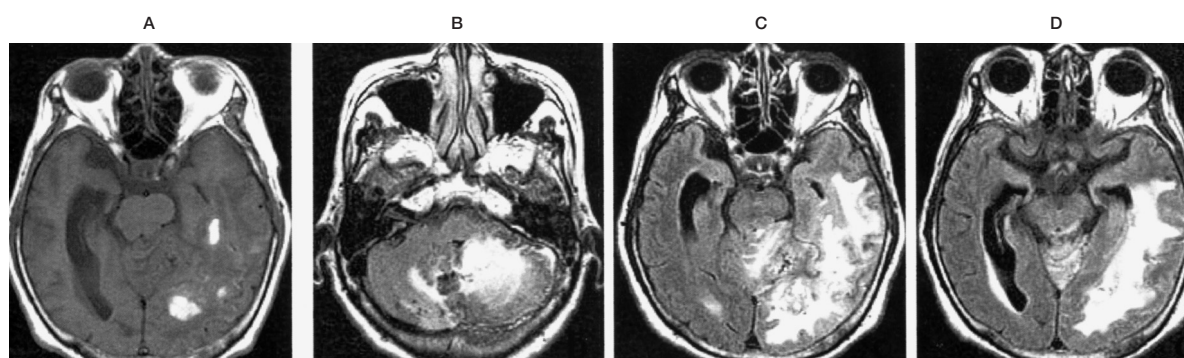


Figure 2 Case 5: 66 y.o. female. Her chief complaints were disturbance of consciousness and aphasia. MRI (T1WI) shows hematoma in left occipital and temporal lobe (A). There is vasogenic edema because of venous congestion in left cerebellar hemisphere (B), left temporal lobe and left occipital lobe (C,D).

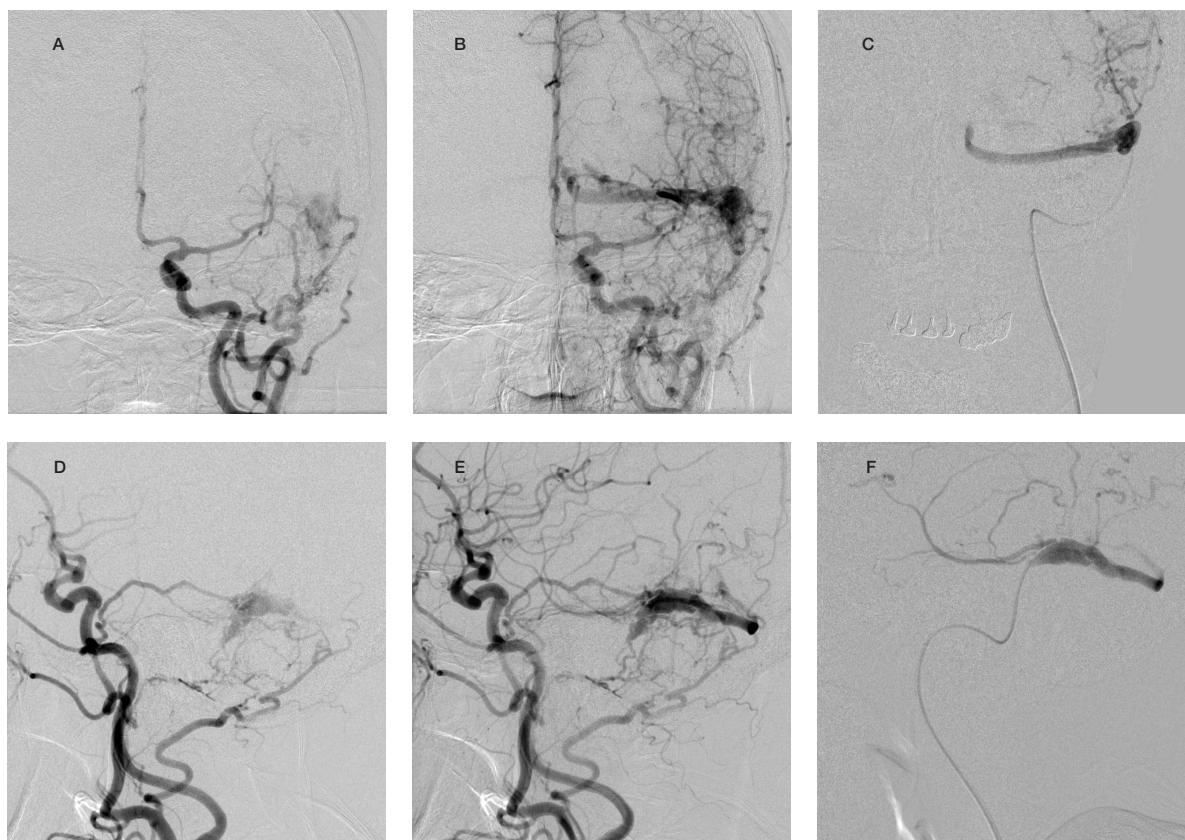


Figure 3 DSA before embolization. Lt. CAG AP view (A,B), lateral view (D,E), venography AP view (C), lateral view (F). There are dural arterio-venous fistulas (dAVFs) in Lt. temporooccipital region. Main feeders are left middle meningeal artery, left occipital artery and left ascending pharyngeal artery flow to the left transverse sinus. There is no left sigmoid sinus because of thrombosis. The drainers are Lt. Labbe's vein and cerebellar and cerebral cortical veins with cortical reflux.

rhage and/or venous infarction, and various symptoms (disturbance of visual acuity and field, ataxia, aphasia and so on) appear¹⁻⁵. Our cases showed venous infarction in all cases and hemorrhage in three cases.

Their clinical symptoms were epilepsy in two cases, aphasia in four cases, visual disturbance in three cases and cerebellar disturbance in two cases.

Angiographically, Djindjian and Merland classified intracranial dAVFs into four types according to their venous drainage patterns⁷. With the development of their classification, Borden et al⁸ classified dAVFs simply into three types by adding spinal dAVFs, and Cognard et al⁹ classified these into five types and three subtypes. Regarding T-S dAVFs, according to the restriction of venous drainage, Lalwani¹⁰ classified four types as follows Grade 1: normal antegrade venous drainage without

cortical reflux, Grade 2: reduction of antegrade flow with retrograde flow or cortical venous drainage, Grade 3: retrograde flow and cortical venous drainage without antegrade flow, Grade 4: venous drainage with only the cortical venous vein. The higher grade of Lalwani's classification, the higher the risk of intracranial hemorrhage and etc. It is therefore necessary to treat T-S dAVFs over Grade 2.

Generally, the treatment for dAVFs involving T-S sinus is transvenous embolization, via which it is easy to insert the microcatheter into the affected sinus and to treat the disease if the affected sinus is not thrombosed; however it is rare to detect and treat this disease at the neurological symptomatic stage (Lalwani's Grade 1) and it is often treated at the aggressive stage (Lalwani's Grade 2-4).

So the T-S sinus may have been already occluded before treatment so it is difficult to treat

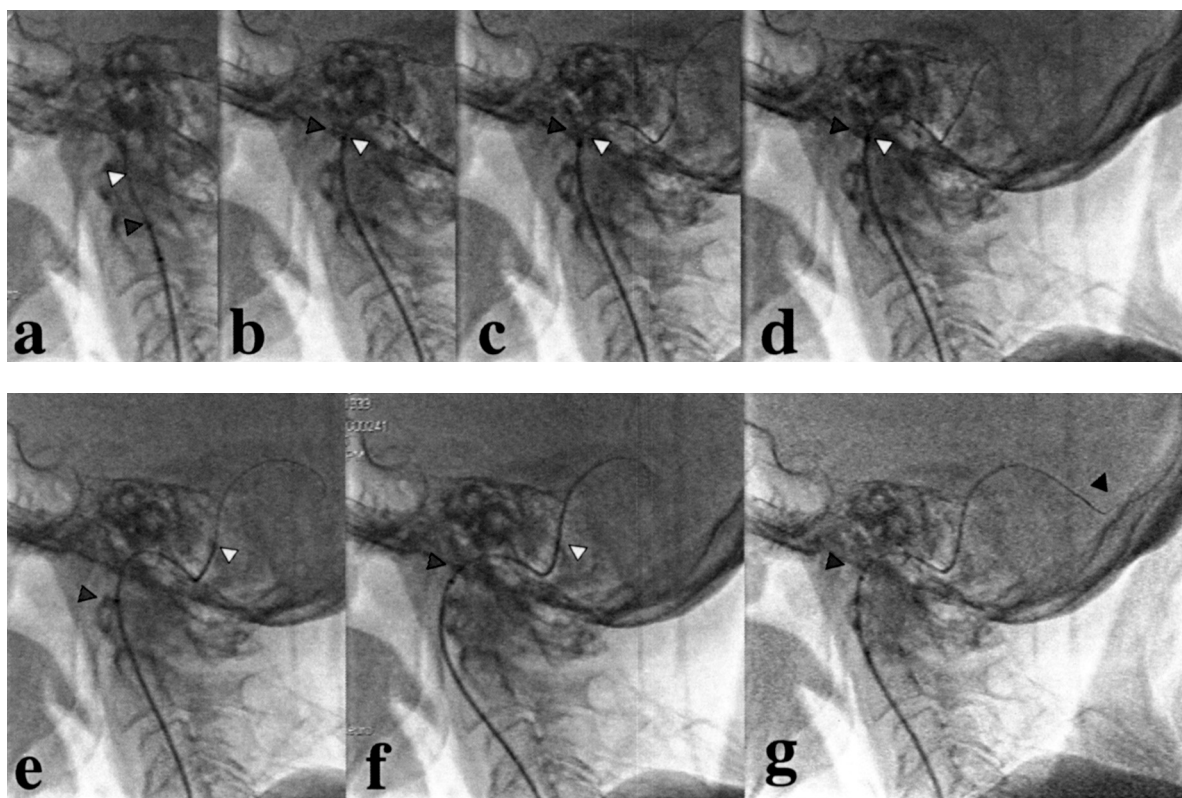


Figure 4 Microcatheterization into transverse sinus (▲ : tip of 6Fr. catheter, Δ tip of 4Fr. catheter, (▲ : tip of microcatheter). A,B) The guidewire is inserted to the thrombosed sigmoid sinus (SS) and 4/6Fr. catheter is wedged at jugular valve. C) The guidewire is inserted to transverse sinus (TS) via SS. D-F) 4Fr. catheter is inserted into transverse-sigmoid junction and 6Fr. catheter is curved because of pushing force. G) The microcatheter is inserted into TS easily.

Table 1 Summary of cases.

case	age/sex	site of lesion	status of sinus	venous infarction	hemorrhage	symptom	treatment	result	Glasgow outcome scale
1	69/M	Left transverse sinus	isolated	yes	no	epilepsy	TVE	cure	Good Recovery
2	42/F	Right transverse-sigmoid sinus	isolated	yes	no	epilepsy	TVE	cure	Good Recovery
3	42/F	Left transverse-sigmoid sinus	isolated	yes	no	aphasia, visual disturbance, headache	TVE	cure	Good Recovery
4	42/F	Left transverse-sigmoid sinus	isolated	yes	no	visual disturbance	TVE	cure	Good Recovery
5	56/M	Left transverse-sigmoid sinus	isolated	yes	yes	aphasia, cerebellar disturbance	TVE	cure	Good Recovery
6	52/M	Left transverse-sigmoid sinus	isolated	yes	yes	aphasia, visual disturbance	TVE	cure	Good Recovery
7	72/M	Left sigmoid sinus	isolated	yes	yes	aphasia, cerebellar disturbance	TVE	cure	Good Recovery
TVE : transvenous embolization									

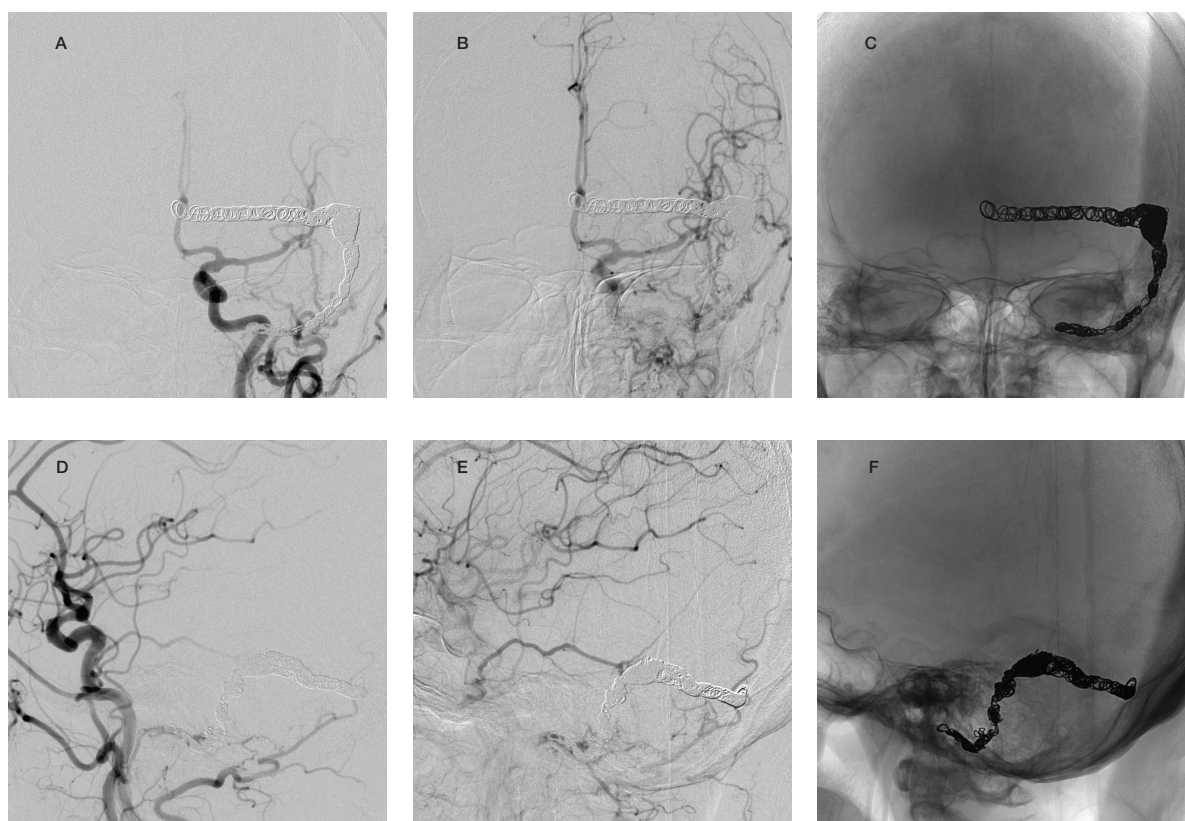


Figure 5 Lt. CAG after embolization. A,B) AP view; D,E) lateral view, craniogram; C) AP view; F) lateral view. Transverse-sigmoid sinus is embolized using IDC and DETACH DCS (total 427 cm). dAVFs have disappeared completely, and she was free of symptoms within a few days.

this disease. There are some reports of treating dAVFs involving an isolated T-S sinus via the ipsilateral^{2,3} or contralateral¹ approach or direct puncture⁶ of the affected sinus.

Nemoto reported opening an occluded sinus with a guidewire, so called kuru-kuru method¹¹. Various methods are used to support the guidewire^{2,3}. We use the triaxial system (6Fr. guiding catheter / 4Fr. diagnostic catheter / microcatheter) to improve the pushability and handling of the guidewire or microcatheter. Usually we use Envoy XB (Cordis) as a 6Fr. guiding catheter, Berenstein catheter (Tonokura) as a 4Fr. diagnostic catheter and Rapid-Transit (Cordis) as a microcatheter. So this system is not specially made and it is easy to obtain and use this system for any neurointerventionalists.

We treat dAVFs involving an isolated T-S sinus with transvenous embolization using this system. By inserting the 4Fr. Catheter to the affected sinus, it is not necessary to manipulate

the microcatheter into the thrombosed sinus. And it is easy to insert the microcatheter into the isolated sinus rapidly.

Without manipulating the microguidewire in the thrombosed sinus, it decreases the complicating risk of intracranial hemorrhage by penetrating the dura matter with microguidewire. We can treat this disease within two hours and it is useful to reduce the exposure time of radiation, so we recommend this technique strongly.

Conclusions

We reported a new technique and combination of devices for the treatment of dAVFs involving the isolated T-S sinus. This technique is very simple and combination of devices can be obtained easily. Using this method it is easy and safe to insert the microcatheter into the isolated sinus and useful to reduce the treatment time.

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